Design of an Optimized Polymer Injection for a Lloydminster Reservoir

Ruijie Gao, Runzhi Li, Yu Zheng (Group# 8)
Supervisor : Dr. Na Jia (Faculty of Petroleum Systems Engineering)

Introduction

Polymer flooding is one of the commonly applied enhance oil recovery method. This method is using polymer solution to increase sweep efficiency by reducing mobility ratio, improve water-injection profile, etc.
Generally, this method is applied for conventional oil which viscosity is lower than 150 cP. But in this project **oil** viscosity is around 5000 cP. The polymer-water alternative injection method has introduced in this project to do the optimization base on **economic evaluation**.

Background

The name of reservoir for this project is **Lloydminster-Alta Commingled pool 011** which is located at Lloydminster Alberta.

Property	Data
Porosity	0.314
API Gravity	16.1
Water Saturation	0.17
Oil Saturation	0.83
Viscosity	5000cP

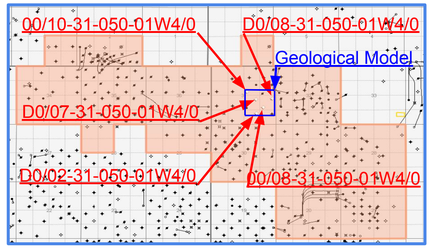
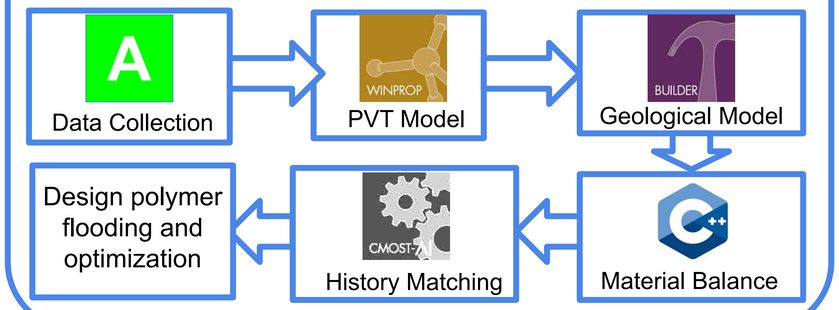


Figure 1. Lloydminster Commingled pool 011 from AccuMap

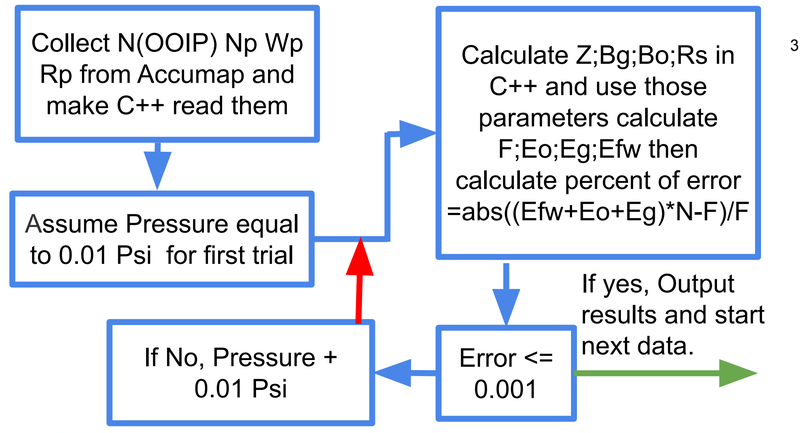
Objectives

- To compare and analyze simulation results of Water Flooding, Polymer Flooding and Primary Production;
- To **design alternative Polymer Flooding process** for different polymer WT%, injection rate and polymer-water injection period from 1989 to 2020;
- To determine the **best alternative** for Polymer Flooding from **economic evaluation**.

Flow Chart for Working Process



Flow Chart for Material Balance



Results

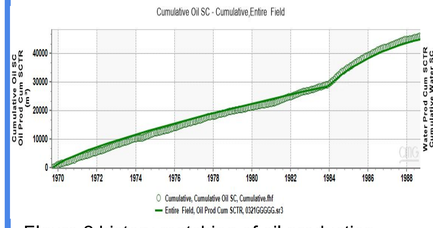


FIgure 2 history matching of oil production

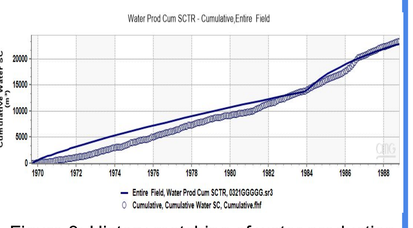


Figure 3: History matching of water production

Different wt% of polymer would inject into the reservoir after the history data get well matched. The optimize method under economic evaluation has found from water flooding, polymer flooding and alternative polymer-water injection.

Economic Evaluation

Table 1 Economic evaluation for different case

Type	ppm	NPV($)	IRR	DROI
WF	0	5.77E+06	94.24%	2.462
PF	1000	8.60E+06	51.78%	3.169
PF-WF	1000	1.01E+07	64.46%	3.857
PF-WF	4000	1.38E+07	34.69%	4.425
PF-WF	5000	1.36E+07	31.54%	4.132

In Table 1 **WF** is stand for water flooding **PF** is for polymer flooding and **PF-WF** means polymer-water alternative injection. **PF-WF with 4000 ppm** is the **best** choice.

Conclusions

- The water flooding and polymer flooding alternative have more economic benefit
- 0.4 wt% at 50 m /day is optimal choice

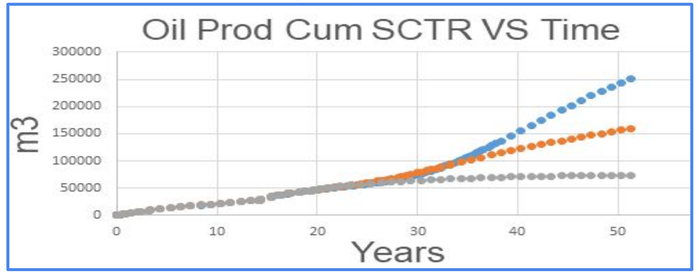


Figure 4. Cumulative Oil Production VS Time

The figure above shows **cumulative oil production** in different methods. From top to bottom three methods are **polymer flooding**, **water flooding** and **primary production**.

Acknowledgments

- **Dr. Na (Jenna)Jia**
- **Mr. Sam Hong**
- **Dr. Saman Azadbakht**
- **Dr. Zhongwei (David) Du**
- **All the faculty members of PSE Program**